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quently to get them to bite or to find their fangs, but have never succeeded, although I did not examine very closely."

Mr. Shindler informs me that he tried a similar experiment with the snake which wounded him, with a like result.

Mr. Swartz, of Washington, related to me another case which occurred in Crescent City, Florida, in which the poison did not seem of a very virulent nature, the bad effects yielding readily to such remedies as the person bitten was able to apply.

5. That coral snake bites are of quite rare occurrence seems due (1) to the lack of abundance of these serpents, especially about towns; (2) to their sluggish disposition, and (3), as Duméril has remarked, to the small size of the mouth, which prevents them from fastening upon any but a sharply curved surface. Elapsoïd serpents are not so little obnoxious in all countries as in North America. They are the scourge of India.

6. Numerous writers of the first half of the present century, and later authors as well, refer to the habits and characteristics of the North American and smaller South American coral snakes.¹ The majority, while alluding to their close relations to the very venomous sections of the family *Elapidae*, regard them as the innocent members of the group.

7. I am indebted to Mr. Shindler for permission to publish the case in which he was the principal; to Dr. Taylor for the medical summary of the same; and to Dr. Kearney, Dr. J. Herff and Mr. Schwartz for information of the other cases cited. Also in an especial manner to Professor Baird, and indirectly to Mr. Bell, for the use of the communication of the latter observer.

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ACHENIAL HAIRS AND FIBERS OF COMPOSITÆ.

BY PROFESSOR G. MACLOSKIE.

THE large order of Composite plants has so much unity of structure, that characters scarcely of specific value elsewhere, are here used for the separation of genera and for limiting sub-orders. Any attempt towards the discovery of additional tribal characteristics is therefore excusable. I have been examining the surface of the achenes, the hairs growing from them and their internal structure, and have found characters scarcely noticed by previous

¹ Duméril and Bibron : *Erpétologie générale*. Holbrook : North American Herpetology, iii, 1842, pp. 50-51. Jordan : *Manual of the Vertebrates*, 1878, p. 183.

writers, and running on the lines of the general affinities of the groups.

The achenial hairs of *Senecio vulgaris* and of *Doria* (*Othonna*) long ago attracted interest; they are double, each having two tubes with a partition between, like the two flues of a double chimney, and they contain within their interior spiral fibers or elaters which are rapidly unwound on the access of moisture,

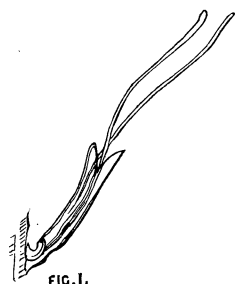


FIG. 1. — Duplex hair from fruit of *Senecio vulgaris*, the elaters protruded.

swelling and escaping by the tips of the tubes, as by the lifting of a pair of trap-doors (Fig. 1).

I have found that other species of the genus *Senecio* have similar hairs. *S. viscosus* L., is represented by De Candolle and by Hooker and Arnott as having glabrous achenes; and *S. triangularis* of Colorado is similarly described by Porter and Coulter. But both these species have duplex achenial hairs with elaters, though less conspicuous than in *S. vulgaris*; and the same is true of the two varieties of *S. aureus*, *balsamita* and *borealis*. The duplex hairs abound most on the angles of the achenes, and are mounted on a pedestal consisting of a pair of cells apposed like the guard-cells of a stome.

The achenial hairs of *Ruckeria*, belonging to the sub-order Calendulaceæ, were shown nearly half a century ago, by Decaisne, to agree with those of *Senecio*. In examining other genera of the Calendulaceæ, I find that in some cases the achenes are glabrous, and that *Calendula arvensis* has multicellular hairs on its achenes like those of the perianth. This I take to be a case of the encroaching of perianth hairs on a neighboring region, which occurs in a number of genera; there being still room for an intermediate set of duplex hairs. I believe that I have found these in *Calendula*, though not so clearly as to make out its affinity with *Senecionidæ* (Fig. 2).

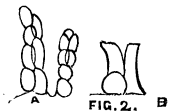


FIG. 2.—Multicellular (A) and duplex hairs (B) from fruit of *Calendula arvensis*.

In the sub-order Inuloideæ the achenial hairs are duplex and obtuse, and mounted on pedestal-cells, like those of *Senecio*, but devoid of elaters. They manifestly represent the elater-bearing hairs already described, and one is tempted to think that they must have shed the elaters, but we have found no traces of such structures even in young flowers (Fig. 3.)

The Asteroideæ and several other sub-orders have duplex hairs without elaters, the two divisions being acute at their tips, more or less divergent, generally unequal in length, one of them being sometimes very short (Fig. 5). These are a further modification of the Inuloid pattern, and some Asteroideæ (as the English daisy (Fig. 4) and *Baccharis ivæfolia*) are of the Inuloid type, whilst *Pluchea fœtida*, placed by Bentham and Hooker among the Inuloids, agrees in this respect with the Asteroids, where DeCandolle placed it in the Prodromus.

In many instances achenes represented by authors as smooth, have some of these duplex hairs indicating their real affinities; and

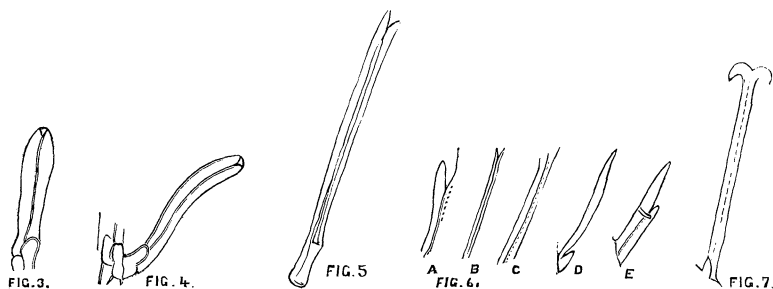


FIG. 3.—Duplex hair, with pedestal-cells, of fruit of *Gnaphalium norvegicum* (Inuloideæ). FIG. 4.—Similar hair of daisy (*Bellis perennis*, of Asteroideæ). FIG. 5.—Duplex hair of fruit of *Erigeron strigosus*, the regular Asteroid type. FIG. 6.—Various forms of duplex achenial hairs: A, of *Sericocarpus conyzoides*; B, of *Chrysopsis villosa*; C, of *Eupatorium* sp.; D, of *Liatris scariosa*; E, of *Eupatorium glechonophyllum*. FIG. 7.—Duplex hairs of fruit of *Townsendia grandiflora*, showing the recurved tips.

in other instances (as *Chrysopsis villosa* and *Sericocarpus*), the duplex hairs are very long and fine, as if they were simple hairs; but still their Asteroid character is easily seen (Fig. 6 B). They are sometimes confined to the achenial angles, the intermediate areas bearing glands. Archer refers to such achenial hairs being bifid at the apex as existing very extensively among the Compositæ (Proc. Linn. Soc., 1861, p. 17), and Kraus briefly speaks of them (Pringsheim's Jahrbücher für Botanik, 1866-7). In *Townsendia* they diverge at the tips so much as to become recurved (Fig. 7). As some species of this genus have glabrous achenes Professor Asa Gray has made the presence or absence of such hooked hairs the ground of splitting the genus into sections. We now see that such distinction depends on the greater or less development of a structure that belongs to all the Asteroids and to

other tribes of Compositæ. It is not improbable that we may find rudiments of the hooked hairs even in such of the species as are described as having glabrous achenes. Descriptive botanists may fairly characterize parts as "smooth" when hairs, if present, are not prominent; but in seeking to find the affinities of tribes and genera, we must do our utmost to detect hidden marks, and thus the structure of these hairs has a higher significance than the degree of their development.

Duplex hairs are general in Asteroideæ, Eupatorieæ, Veroniceæ, Helianthoideæ, Helenioideæ, Arctotideæ, and Mutisieæ, but we have found no trace of them in Anthemideæ or in Cichorieæ. The Cynaroideæ appear to me to present two types of structure; some genera (as *Carlina* and *Xeranthemum*) agree with Asteroideæ; whilst the true thistles agree with Cichorieæ. *Centaurea* (*C. nigra*, *C. scabiosa*, *C. terniflora*) has the achene covered with long simple bristles, like those of the perianth. This is, however, a case of perianth hairs encroaching on the seed-vessel; in some cases (as *Callistephus chinensis*, the China-aster) many-jointed hairs like those of the perianth are intermingled with duplex hairs on the fruit. *Engelmannia* (of Helianthoideæ) is said by Bentham and Hooker to have sub-pilose achenia, but here it is pilose bracts which enclose a glabrous achene; and the same is true of the aberrant *Ambrosia*. *Tagetes erecta* (the large African marigold, of Helenioideæ) has the achenial hairs short and lanceolate, but its congener, *T. patula*, shows that this is a mere variation of the duplex type. In some cases where we should expect to find duplex hairs, a cursory examination will suggest that they are simple; but here a closer view is apt to show the rudiment of the missing half, like a small twin brother, at base of the larger part (as *Liatis scariosa*, Fig. 6, D.). It is always the basal division of the cell which is less fully developed. The partition between the chambers of the duplex hair is usually pitted, and sometimes we could chase air-bubbles up and down the tubes.

The genera of Anthemideæ have, nearly all of them, glabrous fruits, the exceptions being glandular, and very few sub-pilose. I have not seen any of them with hairs; but I find epidermal cells enclosing spiral threads, in *Maruta cotula*, *Anthemis arvensis* and *Leucanthemum*. (Fig. 8.) *Achillea millefolium* seems not to have these, but its pericarp has internal glands within its cells.

The achenial surface of the sub-order, Cichoriæ, is devoid of hairs, and is covered by imbricating flat denticulate cells. The inner cells of the pericarp develop fibers, enclosing crystalloids, which aid in the dehiscence of the fruit, much after the manner of the fibrous layer of pollen-sacs. Thus I found the so-called indehiscent fruit of dandelion in the act of dehiscing, by the aid of its fibers, when moistened, pressing out the seed, and of its crystalloids serving as props and wedges, the tapering form of the seed being well fitted for the process.

Krigia virginica has simple red-brown spines over its fruit, and chicory has elegant multicellular hairs, corresponding with the perianth surface. The thistle group of the Cynaroideæ agree as

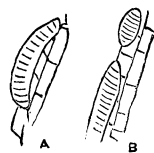


FIG. 8.

FIG. 8.—Epiderm. of pericarp of A, *Marula cotula* and B, *Leucanthemum vulgare*, showing cells enclosing spirals. (Anthemideæ.)



FIG. 9.

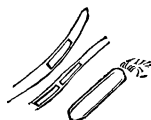


FIG. 10.

FIG. 9.—Denticulate epidermal cells of pericarp of *Lactuca scariola* (Cichoriæ).
FIG. 10.—Endocarpal fibrils and crystalloids of *Cirsium lanceolatum* (Cynaroideæ).

to absence of double hairs, and as to the fibers and crystalloids with the Cichariaceæ.

Professor Asa Gray suggests that the mucilaginous filaments of *Senecio* are probably of service by gluing the achene to the soil, its pappus being thrown off. There is much mucilage in and about the filaments of the Cichoriæ, and it will be an interesting question to determine what are the functions of these and the crystalloids.

The consideration of the facts stated above suggests a somewhat different line of affinities from that usually adopted, and a reëxamination of the tribal unity of Cynaroideæ. We give the orders in the subjoined table, according to the arrangement of Bentham and Hooker. But it is manifest that Anthemideæ and Arctotideæ and Mutisieæ are misplaced, and that other readjustments are to be made, if we are to marshal the groups according to the character here discussed. Yet the parallelism between the structure of the hairs and the affinities of the groups, as founded on other characters, is singularly complete.

In many instances apparent exceptions turned out on reëxamination not to be exceptional; and although our work has been only tentative, enough has been found to demand the attention of synantherologists.

TABLES OF ACHENIAL HAIRS, &c., OF COMPOSITÆ.

- I. Vernoniæ: as in Asteroideæ.
- II. Eupatoriæ: do.
- III. Asteroideæ. Duplex hairs, usually bifurcate, and often unequal, acute at tips. Hairs sometimes few or obsolete: sometimes as in Inuloideæ. No elaters.
- IV. Inuloideæ. Duplex hairs, usually obtuse and equal. No elaters.
- V. Helenioideæ: as in Asteroideæ. Crystalloids in endocarp.
- VI. Anthemideæ. Achenes usually glabrous; but having pericarp cells with spiral filaments. (Glands in *Achillea* within pericarp cells.)
- VII. Senecionideæ. Duplex hairs, having divisions equal, with elaters or filaments, which escape when moistened.
- VIII. Calenduleæ, probably as in Senecionideæ (with multicellular hairs interposed in some).
- IX. Arctotideæ, as in Asteroideæ.
- X. Cynaroideæ. Some as in Asteroideæ (*Carlina*, *Xeranthemum*). Some as in Cichoriaceæ (*Cnicus*, &c.). *Arctium*, *Centaurea*, *Echinops*, &c., have simple hairs on achene like those of perianth.
- XI. Mutisieæ, as in Asteroideæ.
- XII. Cichorieæ. Achenes glabrous, with denticulate epidermal cells. Endocarp having filaments, enclosing crystalloids.

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INSTINCT AND MEMORY EXHIBITED BY THE FLY- ING SQUIRREL IN CONFINEMENT, WITH A THOUGHT ON THE ORIGIN OF WINGS IN BATS.

BY F. H. KING.

IN June, 1879, I obtained a litter of three flying squirrels, *Sciuropterus volucella* (Pall.) Geoff., from a nest built of small twigs and oak leaves, lined with grass, which was situated about ten feet from the ground in a small red oak standing in a grove of the same kind. The nest was a complete ball, from which the inmates escaped without any specially provided opening. No large trees of any kind exist within two miles of the grove, the locality, in its topography and vegetation, being an extension of the Minnesota prairies into Wisconsin.

The squirrels, so small when taken as to escape very readily between the wires of an ordinary canary-bird cage, became very tame and playful at once, they grew rapidly upon cow's